

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: November 4, 2019

TO: Angela Parkhurst – Eau Claire

FROM: Wade Strickland – WY/3

SUBJECT: Water Quality-Based Effluent Limitations for the Elewa Strum Joint Sewerage Commission WWTF
WPDES Permit No. WI-0064998-02-0

This is in response to your request for an evaluation of the need for water quality-based effluent limitations using Chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from the Elewa Strum Joint Sewerage Commission wastewater treatment facility in Trempealeau County. This municipal wastewater treatment facility (WWTF) discharges to the Buffalo River, located in the Upper Buffalo River Watershed in the Buffalo-Trempealeau River Basin. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
BOD ₅			45 mg/L	30 mg/L		1
TSS			45 mg/L	30 mg/L		1
pH	9.0 s.u.	6.0 s.u.				1
Fecal Coliforms May – September			656#/100 mL geometric mean	400#/100 mL geometric mean		2
Ammonia Nitrogen Year-round	7.8 mg/L		7.8 mg/L	7.8 mg/L		2,3
Phosphorus Interim Final				0.4 mg/L 0.225 mg/L	0.075 mg/L 0.126 lbs/day	4
Acute WET	1.0 TUa					5
Chronic WET						6

Footnotes:

1. No changes from the current permit
2. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7) are included in bold.
3. The variable daily maximum ammonia nitrogen limit table corresponding to various effluent pH values may be included in the permit in place of the single limit. If this option is chosen, a weekly and monthly average limit of 108 mg/L is recommended to accompany the variable daily maximum limits applicable year-round. The following variable daily limits would apply:

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
6.0 < pH ≤ 6.1	108	7.0 < pH ≤ 7.1	66	8.0 < pH ≤ 8.1	14
6.1 < pH ≤ 6.2	106	7.1 < pH ≤ 7.2	59	8.1 < pH ≤ 8.2	11
6.2 < pH ≤ 6.3	104	7.2 < pH ≤ 7.3	52	8.2 < pH ≤ 8.3	9.4
6.3 < pH ≤ 6.4	101	7.3 < pH ≤ 7.4	46	8.3 < pH ≤ 8.4	7.8
6.4 < pH ≤ 6.5	98	7.4 < pH ≤ 7.5	40	8.4 < pH ≤ 8.5	6.4
6.5 < pH ≤ 6.6	94	7.5 < pH ≤ 7.6	34	8.5 < pH ≤ 8.6	5.3
6.6 < pH ≤ 6.7	89	7.6 < pH ≤ 7.7	29	8.6 < pH ≤ 8.7	4.4
6.7 < pH ≤ 6.8	84	7.7 < pH ≤ 7.8	24	8.7 < pH ≤ 8.8	3.7
6.8 < pH ≤ 6.9	78	7.8 < pH ≤ 7.9	20	8.8 < pH ≤ 8.9	3.1
6.9 < pH ≤ 7.0	72	7.9 < pH ≤ 8.0	17	8.9 < pH ≤ 9.0	2.6

4. If the phosphorus variance application that was submitted is approved by EPA, the proposed interim limit of 0.4 mg/L as a monthly average may be extended beyond the end of the compliance schedule along with a requirement for total phosphorus pollutant minimization program.
5. According to the requirements specified in s. NR 106.08, Wis. Adm. Code, an acute WET limit is required. The acute WET limit should be expressed as 1.0 TUa as a daily maximum in the effluent limits table of the permit. Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing shall continue after the permit expiration date (until the permit is reissued). Sampling WET concurrently with any chemical-specific toxic substances is recommended.
6. No chronic WET testing is recommended.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Benjamin Hartenbower at (715) 839-3712 (Benjamin.Hartenbower@wisconsin.gov) or Diane Figiel at (608) 264-6274 (Diane.Figiel@wisconsin.gov).

Attachments (2) – Narrative & Map

PREPARED BY: Shaun Shields – Water Resources Engineer

APPROVED BY: _____ Date: _____
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Attachment #1
**Water Quality-Based Effluent Limitations for
Eleva Strum Joint Sewerage Commission WWTF**

WPDES Permit No. WI-0064998-02-0

Prepared by: Shaun Shields

PART 1 – BACKGROUND INFORMATION

Facility Description: The Eleva Strum Joint Sewerage Commission WWTF receives domestic wastewater from the villages of Eleva and Strum as well as 800-1000 gpd of industrial wastewater from North American Fly. The facility became operational in November 2013. With an annual average design flow of 0.201 MGD, the facility utilizes enhanced biological nutrient removal, activated sludge, and UV disinfection processes to treat wastewater.

Attachment #2 is a map of the area showing the approximate location of Outfall 001.

Existing Permit Limitations: The current permit, which expired on 07/30/2018, includes the following effluent limitations.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
BOD ₅			45 mg/L	30 mg/L		
TSS			45 mg/L	30 mg/L		
pH	9.0 s.u.	6.0 s.u.				
Fecal Coliforms May – September				400#/100 mL geometric mean		1
Ammonia Nitrogen						2
Phosphorus Interim Final				1.0 mg/L 0.225 mg/L	0.075 mg/L	
Copper, Total Recoverable	21 µg/L 0.047 lbs/day					3
Acute WET						4

Footnotes:

1. Limits and monitoring apply May – September
2. Monitoring only
3. Hardness monitoring performed concurrently with copper sampling
4. Acute WET testing required between January – March 2015 and July – September 2017

Receiving Water Information:

- Name: Buffalo River
- Classification: Warm water sport fish community, non-public water supply.
- Low Flow: The following 7-Q₁₀ and 7-Q₂ values are from USGS for Station located at SW ¼ SE ¼ Sec 18 T24N-R8W at Strum, upstream of where Outfall 001 is located.
7-Q₁₀ = 21 cfs (cubic feet per second)
7-Q₂ = 37 cfs

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- Hardness = 94 mg/L as CaCO₃. This value represents the geometric mean of data from monitoring station # 623253 and WET testing from the Eleva Strum WWTF with results from 01/04/1996 to 09/27/2006.
- % of low flow used to calculate limits: 25%
- Source of background concentration data: Metals data from the Chippewa River at Durand is used for this evaluation because there is no metals data available for the Buffalo River. The Chippewa River is within the same ecological landscape so ambient water quality characteristics are expected to be similar. The numerical values are shown in the tables below. If no data is available, the background concentration is assumed to be negligible and a value of zero is used in the computations. Background data for calculating effluent limitations for ammonia nitrogen are described later. Ambient chloride in the Buffalo River is estimated at 12 mg/L based on past monitoring efforts at the Village of Strum.
- Multiple dischargers: No other dischargers are present in this section of the Buffalo River; therefore, they do not impact this evaluation.
- Impaired water status: Buffalo River is impaired for total phosphorus.

Effluent Information:

- Design Flow Rate(s):
Annual Average = 0.201 MGD
The Daily Maximum Design Flow is estimated as follows:
Daily Maximum Peaking Factor = Peak Daily Flow ÷ Yearly Average Flow
Daily Maximum Design Flow = Daily Maximum Peaking Factor × Annual Average Design Flow

Year	Annual Average (MGD)	Peak Daily Flow (MGD)	Peaking Factor	Daily Maximum Design Flow (MGD)
2016	0.110	0.494	4.47	0.899
2017	0.105	0.240	2.29	0.460
2018	0.105	0.834	7.92	1.59
Average				0.983

An estimated Daily Maximum Design Flow of 0.983 MGD will be used in estimating mass limits. For reference, the actual average flow from 11/01/2013 to 02/28/2019 was 0.11 MGD.

- Hardness = 121 mg/L as CaCO₃. This value represents the geometric mean of data from DMR and permit application 11/05/2013 – 12/28/2019.
- Acute dilution factor used: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water Source: Well Water
- Additives: Chemical addition for phosphorus removal
- Effluent characterization: This facility is categorized as a minor municipal discharger, so the permit application required effluent sample analyses Total Nitrogen, Total Kjeldahl Nitrogen, Nitrate and Nitrite Nitrogen, As, Cd, Cr, Pb, Ni, and Zn in addition to those pollutants specified in permit effluent limits and monitoring.

Sample Date	Chloride mg/L
10/16/2017	58.1
10/23/2017	59.3
10/30/2017	58.4
11/06/2017	55.2
Mean	57.7

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Sample Date	Zinc µg/L
10/16/2017	64.3
09/18/2019	17
09/25/2019	24
10/02/2019	33
10/08/2019	25
Mean	32.7

11/07/2013 – 07/30/2019	Copper µg/L
1-day P ₉₉	23.3
4-day P ₉₉	12.8
30-day P ₉₉	7.25
Mean	4.90
Std	4.74
Sample size	70
Range	3 - 29

Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled “MEAN EFFL. CONC.”.

The following table presents the average concentrations and loadings at Outfall 001 from 11/01/2013 – 07/30/2019 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6):

	Average Measurement	Average Mass Discharged
BOD ₅	10 mg/L*	
TSS	4.22 mg/L	
pH field	7.36 s.u.	
Phosphorus	0.42 mg/L	
Fecal Coliform	152 #/100mL*	
Copper, Total Recoverable	4.89 µg/L	0.0042 lbs/day

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

In general, permit limits for toxic substances are recommended whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P₉₉) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q₁₀

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Adm. Code (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q₁₀ receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards.

$$\text{Limitation} = \frac{(\text{WQC}) (Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)}{Q_e}$$

Where:

WQC = Acute toxicity criterion or secondary acute value according to ch. NR 105

Q_s = average minimum 1-day flow which occurs once in 10 years (1-day Q₁₀)

if the 1-day Q₁₀ flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q₁₀).

Q_e = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d)

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

C_s = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e).

As a rule of thumb, if the receiving water is effluent dominated under low stream flow conditions, the 1-Q₁₀ method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations.

The following tables list the water quality-based effluent limitations for this discharge along with the results of effluent sampling for all the detected substances. All concentrations are expressed in term of micrograms per Liter (µg/L), except for hardness and chloride (mg/L) and mercury (ng/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 16.8 cfs, (1-Q₁₀ (estimated as 80% of 7-Q₁₀)).

SUBSTANCE	REF. HARD. mg/L	ATC	MEAN BACK-GRD.	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P ₉₉	1-day MAX. CONC.
Arsenic		340		649	136	<0.41		
Cadmium	121	12.8	0.0048	25.7	5.1	<0.08		
Chromium (+3)	121	2108	0.35	4215	843	0.66		
Copper	121	18.6	1.05	37.1			23	29.0
Lead	121	129	0.23	257	51.4	0.78		
Nickel	121	551		1103	221	2.28		
Zinc	121	142	1.19	284	56.9	32.7		
Chloride (mg/L)		757	12	1514	303	57.7		

* * The 2 x ATC method of limit calculation yields a more restrictive limit than consideration of ambient concentrations and 1-Q₁₀ flow rates per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)RECEIVING WATER FLOW = 5.25 cfs (¼ of the 7-Q₁₀)

SUBSTANCE	REF. HARD.* mg/L	CTC	MEAN BACK- GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P ₉₉
Arsenic		152		2721	544	<0.41	
Cadmium	94	2.35	0.0048	42.0	8.4	<0.08	
Chromium (+3)	94	126	0.35	2240	448	0.66	
Copper	94	9.82	1.05	158			13
Lead	94	26.4	0.23	468	93.6	0.78	
Nickel	94	49.5		886	177	2.28	
Zinc	94	114	1.19	2019	404	32.7	
Chloride (mg/L)		395	12	6860	1372	57.7	

Monthly Average Limits based on Wildlife Criteria (WC)

The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

Monthly Average Limits based on Human Threshold Criteria (HTC)

RECEIVING WATER FLOW = 13.5 cfs (¼ of the Harmonic Mean)

SUBSTANCE	HTC	MEAN BACK- GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	370	0.0048	16445	3289	<0.08
Chromium (+3)	3818000	0.35	169697779	33939556	0.66
Lead	140	0.23	6213	1243	0.78
Nickel	43000		1911211	382242	2.28

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 13.5 cfs (¼ of the Harmonic Mean)

SUBSTANCE	HCC	MEAN BACK- GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3		591.1	118	<0.41

Conclusions and Recommendations:

Based on a comparison of the effluent data and calculated effluent limitations, no limits for these toxic chemicals are recommended.

Mercury – The permit application did not require monitoring for mercury because the Elewa Strum Joint Sewerage Commission WWTF is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3., a minor municipal discharger shall monitor, and report results of influent and effluent mercury monitoring once every three months if, “there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5).” A review of the past five years of sludge characteristics data reveals that

all the sample results are within expected analytical ranges and well below the 17 mg/kg level. The average concentration in the sludge from 10/02/2014 to 01/01/2018 was 2.35 mg/kg, with a maximum reported concentration of 4.5 mg/kg. Therefore, no mercury monitoring is recommended at Outfall 001.

Copper – The current permit contains daily maximum limits for copper. Copper and hardness monitoring data suggest levels which are below the calculated limits based on acute and chronic toxicity. Since the wastewater treatment facility currently provides no active treatment, suspension of the limit is unlikely to result in an increase in copper beyond the calculated limits due to a lack of treatment.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for this substance effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. Given the fact that the Eleva Strum Joint Sewerage Commission WWTF does not currently have ammonia nitrogen limits the need for limits is evaluated at this time.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC):

Daily maximum limitations are based on acute toxicity criteria, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation.

$$\text{ATC in mg/L} = [A \div (1 + 10^{(7.204 - \text{pH})})] + [B \div (1 + 10^{(\text{pH} - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Warm Water Sport fishery, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data for the past three years was examined as part of this evaluation. A total of 2099 sample results were reported from 11/01/2013 to 7/31/2019. The maximum reported value was 8.6 s.u. (Standard pH Units). More than 99% of the time the pH was 8.4 s.u. or less. The 1-day P_{99} , calculated in accordance with s. NR 106.05(5), is 8.39 s.u. And the mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 8.4 s.u. A value of 8.4 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 8.14 s.u. into the equation above yields an ATC = 3.88 mg/L and a computed daily maximum limit of 7.8 mg/L using two times the ATC.

Potential changes to daily maximum Ammonia Nitrogen effluent limitations:

Updates to subchapter IV of ch. NR 106, Wis. Adm. Code (effective September 1, 2016) outline the option for the Department to implement use of the 1- Q_{10} receiving water low flow to calculate daily maximum ammonia nitrogen limits if it is determined that the previous method of acute ammonia limit calculation ($2 \times \text{ATC}$) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits would apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1- Q_{10} (estimated as 80 % of 7- Q_{10}) and the $2 \times \text{ATC}$ approach are shown below.

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	Ammonia Nitrogen Limit mg/L
2×ATC	7.8
1-Q ₁₀	210

The 2×ATC method yields the most stringent limits for the Eleva Strum Joint Sewerage Commission WWTF.

Presented below is a table of daily maximum limitations corresponding to various effluent pH values. Use of this table is not necessarily recommended in the permit, but it is presented herein for informational purposes.

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
6.0 < pH ≤ 6.1	108	7.0 < pH ≤ 7.1	66	8.0 < pH ≤ 8.1	14
6.1 < pH ≤ 6.2	106	7.1 < pH ≤ 7.2	59	8.1 < pH ≤ 8.2	11
6.2 < pH ≤ 6.3	104	7.2 < pH ≤ 7.3	52	8.2 < pH ≤ 8.3	9.4
6.3 < pH ≤ 6.4	101	7.3 < pH ≤ 7.4	46	8.3 < pH ≤ 8.4	7.8
6.4 < pH ≤ 6.5	98	7.4 < pH ≤ 7.5	40	8.4 < pH ≤ 8.5	6.4
6.5 < pH ≤ 6.6	94	7.5 < pH ≤ 7.6	34	8.5 < pH ≤ 8.6	5.3
6.6 < pH ≤ 6.7	89	7.6 < pH ≤ 7.7	29	8.6 < pH ≤ 8.7	4.4
6.7 < pH ≤ 6.8	84	7.7 < pH ≤ 7.8	24	8.7 < pH ≤ 8.8	3.7
6.8 < pH ≤ 6.9	78	7.8 < pH ≤ 7.9	20	8.8 < pH ≤ 8.9	3.1
6.9 < pH ≤ 7.0	72	7.9 < pH ≤ 8.0	17	8.9 < pH ≤ 9.0	2.6

Weekly Average & Monthly Average Limits based on Chronic Toxicity Criteria (CTC)

Weekly average and monthly average limits for ammonia nitrogen are based on chronic toxicity criteria. The 30-day chronic toxicity criterion (CTC) for ammonia in waters classified as a Warm Water Sport Fish Community is calculated by the following equation.

$$CTC = E \times \{ [0.0676 \div (1 + 10^{(7.688 - pH)})] + [2.912 \div (1 + 10^{(pH - 7.688)})] \} \times C$$

Where:

pH = the pH (s.u.) of the receiving water,

E = 0.854,

C = the minimum of 2.85 or $1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Present), or

C = $1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Absent), and

T = the temperature (°C) of the receiving water – (Early Life Stages Present), or

T = the maximum of the actual temperature (°C) and 7 – (Early Life Stages Absent)

The 4-day criterion is simply equal to the 30-day criterion multiplied by 2.5. The 4-day criteria are used in a mass-balance equation with the 7-Q₁₀ (4-Q₃, if available) to derive weekly average limitations. And the 30-day criteria are used with the 30-Q₅ (estimated as 85% of the 7-Q₂ if the 30-Q₅ is not available) to derive monthly average limitations. The stream flow value is further adjusted to temperature; 100% of the

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flow is used if the Temperature ≥ 16 °C, 25% of the flow is used if the Temperature < 11 °C, and 50% of the flow is used if the Temperature ≥ 11 °C but < 16 °C.

The rules provide a mechanism for less stringent weekly average and monthly average effluent limitations when early life stages (ELS) of critical organisms are absent from the receiving water. This applies only when the water temperature is less than 14.5 °C, during the winter and spring months. Burbot, an early spawning species, are not believed to be present in the Buffalo River, based on conversations with local fisheries biologists. So “ELS Absent” criteria apply from October through March, and “ELS Present” criteria will apply from April through September for a Warm Water Sport Fishing classification.

Since minimal ambient data is available, the “default” basin assumed values are used for Temperature, pH and background ammonia concentrations, shown in the table below, with the resulting criteria and effluent limitations:

		Spring	Summer	Winter
		April & May	June – Sept.	Oct. - March
Effluent Flow	Qe (MGD)	0.201	0.201	0.201
Background Information	7-Q ₁₀ (cfs)	21	21	21
	7-Q ₂ (cfs)	37	37	37
	Ammonia (mg/L)	0.07	0.04	0.03
	Temperature (°C)	12	19	10
	pH (s.u.)	7.69	7.74	7.59
	% of Flow used	50	100	25
	Reference Weekly Flow (cfs)	10.5	21	5.25
	Reference Monthly Flow (cfs)	15.73	31.45	7.86
Criteria mg/L	4-day Chronic			
	Early Life Stages Present	9.05	5.79	
	Early Life Stages Absent			13.43
	30-day Chronic			
	Early Life Stages Present	3.62	2.32	
	Early Life Stages Absent			5.37
Effluent Limitations mg/L	Weekly Average			
	Early Life Stages Present	312	394	
	Early Life Stages Absent			240
	Monthly Average			
	Early Life Stages Present	183	233	
	Early Life Stages Absent			140

Effluent Data

The following table evaluates the statistics based upon ammonia data reported from 06/01/2015 to 02/28/2019, with those results being compared to the calculated limits to determine the need to include ammonia limits in the Eleva Strum Joint Sewerage Commission WWTF permit for the respective month ranges. This data range was chosen to reflect the representative ammonia discharge after plant start-up had been achieved and operated smoothly. That need is determined by calculating 99th upper percentile (or P₉₉) values for ammonia during each of the month ranges and comparing the daily maximum values to the daily maximum limit. Based on this comparison, daily limits are necessary year-round.

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Ammonia Nitrogen (mg/L) 06/01/2015 – 07/02/2019	April – May	June – September	October – March
1-day P ₉₉	21.2	2.9	10.9
4-day P ₉₉	12.5	1.8	6.4
30-day P ₉₉	5.33	0.74	2.74
Mean *	2.31	0.29	1.22
Std	5.16	0.74	2.63
Sample size	12	65	61
Range	0.1 - 13.4	0.01 - 4.7	0.1 - 11.8

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

It is noted that Eleva-Strum Joint Sewerage District reported many ammonia results at the limit of detection but not as below the limit of detection. Non-detect results should be reported accurately so that the effluent statistics may be calculated appropriately. Since several ammonia results exceeded 7.8 mg/L, daily limits are recommended regardless of the potential reporting issues with ammonia results.

Conclusions and Recommendations:

In summary, after rounding to two significant figures, the following ammonia nitrogen limitations are recommended based on reasonable potential. No mass limitations are recommended in accordance with s. NR 106.32(5).

	Daily Maximum
Year Round	7.8 mg/L

The permittee may elect to comply ammonia limits through limits which vary with effluent pH. Additional limits to comply with expression of limit requirements are outlined in Part 7 of this document.

PART 4 –PHOSPHORUS

Technology Based Effluent Limit (TBL)

Wisconsin Administrative Code, ch. NR 217, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of Total Phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit.

Because the Eleva Strum Joint Sewerage Commission WWTF currently has a 1.0 mg/L limit, this limit should be retained in the reissued permit. This limit remains applicable unless a more stringent water quality-based concentration limit is given.

Water Quality-Based Effluent Limits (WQBEL)

Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to ch. NR 102 (s. NR 102.06), which establish phosphorus standards for surface waters. Revisions to ch. NR 217 (s. NR 217, Subchapter III) establish procedures for determining water quality based effluent limits for phosphorus, based on the applicable standards in ch. NR 102.

The conservation of mass equation is described in s. NR 217.13 (2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs):

$$\text{Limitation} = [(WQC)(Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)] / Q_e$$

Where:

WQC = 0.075 mg/L for the Buffalo River

Q_s = 100% of the 7-Q₂ of 37 cfs

C_s = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code

Q_e = effluent flow rate = 0.201 MGD = 0.311 cfs

f = the fraction of effluent withdrawn from the receiving water = 0

A previous evaluation resulted in a WQBEL of 0.075 mg/L using a background concentration of 0.225 mg/L. Section NR 217.13(2)(d) states that the determination of upstream concentrations shall be evaluated at each permit reissuance. Additional data were considered in estimating the background phosphorus concentration.

Section NR 217.13(2)(d), Wis. Adm. Code, specifies that the background phosphorus concentration used in the limit calculation formula shall equal the median of at least four samples collected during the months of May through October, and that all samples collected during a 28-day period shall be considered as a single sample and the average of these concentrations used to determine a median. Averaging begins at date of the first sample in the range of May through October.

In stream total phosphorus data directly upstream of the discharge is not available however the following data were considered in estimating the background phosphorus concentration:

SWIMS ID	623092	10009825	10015005
Station Name	Monitoring station at Railroad Bridge	Monitoring station at Station 1 Spruce Rd	Monitoring station at Cth A
Waterbody	Buffalo River	Graham Creek	Harvey Creek
Sample Count	6	9	6
First Sample	05/09/2012	05/07/2008	05/22/2017
Last Sample	10/09/2012	07/05/2017	10/12/2017
Mean	0.221 mg/L	0.353 mg/L	0.221 mg/L
Median	0.225 mg/L	0.322 mg/L	0.212 mg/L
NR 217 Median	0.225 mg/L	0.322 mg/L	0.212 mg/L

In stream total phosphorus monitoring from upstream and monitoring stations in the watershed indicate total phosphorus levels above the 0.075 mg/L criterion.

Substituting a median value of 0.22 mg/L into the limit calculation equation above would result in a calculated limit that is less than the applicable criterion of 0.075 mg/L. However, s. NR 217.13(7), Wis. Adm. Code, specifies that “if the water quality-based effluent limitation calculated pursuant to the procedures in this section is less than the phosphorus criterion specified in s. NR 102.06, Wis. Adm. Code, for the water body, the effluent limit shall be set equal to the criterion.”

Effluent Data

The following table summarizes effluent total phosphorus monitoring data. Monitoring data from 05/30/2015 to 07/31/2019 is believed to be more representative of current treatment capabilities.

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Phosphorus mg/L	05/30/2015 to 07/31/2019	05/30/2015 to 07/31/2019*
1-day P ₉₉	2.2	1.3
4-day P ₉₉	1.3	0.68
30-day P ₉₉	0.55	0.33
Mean	0.22	0.19
Std	0.56	0.27
Sample size	653	650
Range	0.05 - 10.4	0.05 – 2.74

*Statistics were derived after removing three large effluent phosphorus results (01/08/2019: 10.4 mg/L, 07/06/2018: 5.8 mg/L, & 07/31/2018: 4.54 mg/L)

These results were eliminated from calculating statistics due to their abnormally high concentration, and as such, may not reflect typical operation.

Reasonable Potential Determination

Since the 30-day P₉₉ of reported effluent total phosphorus data is above the calculated WQBEL, **the discharge has reasonable potential to cause or contribute to an exceedance of the water quality criterion.** Therefore, **a water quality-based effluent limit is recommended.**

Limit Expression

Because the calculated WQBEL is less than or equal to 0.3 mg/L, the effluent limit of 0.075 mg/L may be expressed as a six-month average. If a concentration limitation expressed as a six-month average is included in the permit, a monthly average concentration limitation of 0.225 mg/L, equal to three times the WQBEL calculated under s. NR 217.13 shall also be included in the permit. The six-month average should be averaged during the months of May – October and November – April.

Mass Limits

Because the discharge is to a surface water that impaired for total phosphorus, a mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code. **This final mass limit shall be 0.075 mg/L × 8.34 × 0.201 MGD = 0.126 lbs/day expressed as a six-month average.**

Interim Limit

An interim limit is required per s. NR 217.17, Wis. Adm. Code, when a compliance schedule is needed in the permit to meet the WQBEL. The interim limit should reflect a concentration that the facility is able to meet without investing in additional “temporary” treatment, but also should prevent backsliding from current conditions. Therefore, **it is recommended that the interim limit be set equal to 0.4 mg/L for permit reissuance along with requirements for optimization of phosphorus removal.** It is noted that the permittee requested a variance interim limit of 0.4 mg/L which is greater than the calculated 30-day P₉₉ of 0.33 mg/L, but less than the 4-day P₉₉ of 0.68 mg/L.

Variance Request

The existing permit includes a 7 to 9-year compliance schedule to meet the final WQBEL tentatively by 12/31/2021. The facility has applied for an individual variance under s. 283.15, Wis. Stats. Eligibility for the variance is not included as part of this review. If a variance is granted and approved by US Environmental Protection Agency, **the interim limit of 0.4 mg/L may be extended beyond the end of the compliance schedule.**

PART 5 –THERMAL

New surface water quality standards for temperature took effect on October 1, 2010. These new regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

Due to the amount of upstream flow available for dilution in the limit calculation ($Q_s:Q_e = 105:1 > 20:1$), the lowest calculated limitation is 120° F (s. NR 106.55(6)(a)).

Reasonable Potential

At temperatures above ~103°F, conventional biological treatment systems stop functioning properly and experience upsets. There is no indication that this has ever occurred at this treatment system. This information, coupled with the lack of significant industrial heat load, lead to the conclusion that there is no reasonable potential for the discharge to exceed the 120°F limitation. No limit is recommended to be included in the reissued permit for temperature.

PART 6 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. The following evaluation is based on procedures in the Department's WET Program Guidance Document (October 29, 2019).

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC₅₀ (Lethal Concentration to 50% of the test organisms) greater than 100% effluent.
- Chronic testing is usually not recommended where the ratio of the 7-Q₁₀ to the effluent flow exceeds 100:1. For the Elewa Strum, that ratio is approximately 105:1. With this amount of dilution, there is believed to be little potential for chronic toxicity effects in the Buffalo River associated with the discharge from the Elewa Strum, so the need for chronic WET testing will not be considered further.
- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.
- Shown below is a tabulation of all available WET data for Outfall 001. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data. Data which is not believed to be representative of the discharge is not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations.

WET Data History

Date Test Initiated	Acute Results LC ₅₀ % (% survival in 100% effluent)			
	<i>C. dubia</i>	Fathead minnow	Pass or Fail?	Used in RP?
03/18/2015	100	72.4	Fail	Yes
04/29/2015	100	100	Pass	Yes
05/13/2015	100	100	Pass	Yes
07/19/2017	100	100	Pass	Yes
09/05/2018	100	100	Pass	Yes

- WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the predicted value. **WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.**

According to s. NR 106.08(6)(d), TU_a and TU_c effluent values are equal to zero whenever toxicity is not detected (i.e. when the LC₅₀, IC₂₅ or IC₅₀ ≥ 100%,).

Chronic Reasonable Potential = 0 < 1.0, reasonable potential is not shown, and a limit is not required.

Acute Reasonable Potential = [(TU_a effluent) (B)]

TU _a (maximum) 100/LC ₅₀	B (multiplication factor from s. NR 106.08(5)(c), Wis. Adm. Code, Table 4)
100/ 72.4 = 1.38	Multiplication factor 6.2 Based on 1 detects

$$[(TU_a \text{ effluent}) (B)] = 8.56 > 1.0$$

Expression of WET limits

Acute WET limit = 1.0 TU_a (daily maximum)

WET Checklist Summary

	Acute
AMZ/IWC	Not Applicable 0 Points
Historical Data	1 test used to calculate RP = 8.56 1 test failed
Effluent Variability	Little variability, no violations or upsets, consistent WWTF operations. 0 Points

Attachment #1

	Acute
Receiving Water Classification	Full Fish & Aquatic Life 5 Points
Chemical-Specific Data	Limits for Zinc and Ammonia based on ATC; Chloride, Lead, Nickel, Copper & Chromium detected 8 Points
Additives	0 Biocides 1 Water Quality Conditioners added SorbX-100 Used: No 1 Points
Discharge Category	One Industrial Contributor 5 Points
Wastewater Treatment	Secondary or Better 0 Points
Downstream Impacts	No impacts known 0 Points
Total Checklist Points:	19 Points
Recommended Monitoring Frequency (from Checklist):	1x yearly throughout permit term (rotating quarters)
Limit Required?	Yes Limit = 1 TU _a
TRE Recommended? (from Checklist)	No

- Following the guidance provided in the Department's WET Program Guidance Document (October 29, 2019), based upon the point totals generated by the WET Checklist, other information given above, and Chapter 1.3 of the WET Guidance Document, annual acute WET tests are recommended in the reissued permit. Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing shall continue after the permit expiration date (until the permit is reissued). No chronic WET testing is recommended.
- According to the requirements specified in s. NR 106.08, Wis. Adm. Code, an acute WET limit is required. The acute WET limit should be expressed as 1.0 TU_a as a daily maximum in the effluent limits table of the permit.

PART 7 – EXPRESSION OF LIMITS

Revisions to chs. NR 106 and 205, Wis. Adm. Code align Wisconsin's water quality-based effluent limitations with 40 CFR 122.45(d), which requires WPDES permits contain the following concentration limits, whenever practicable and necessary to protect water quality:

- Weekly average and monthly average limitations for continuous discharges subject to ch. NR 210.
- Daily maximum and monthly average limitations for all other discharges.

The Eleva Strum Joint Sewerage Commission WWTF is a municipal treatment facility and is therefore subject to weekly average and monthly average limitations whenever limitations are determined to be necessary.

This evaluation provides additional limitations necessary to comply with the expression of limits in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code. Pollutants already compliant with these rules or that have an approved impracticability demonstration, are excluded from this evaluation including water-quality based effluent limitations for phosphorus, temperature, and pH, among other parameters. Mass limitations are not subject to the limit expression requirements if concentrations limits are given.

Method for calculation:

The methods for calculating limitations for continuous discharges subject to ch. NR 210 to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(3), and are as follows:

1. Whenever a daily maximum limitation is determined necessary to protect water quality, a weekly and monthly average limitation shall also be included in the permit and set equal to the daily maximum limit unless a more restrictive limit is already determined necessary to protect water quality.
 - The calculated weekly and monthly average ammonia limits in part 3 of this document are less stringent than the applicable daily maximum limit. Therefore, the weekly and monthly average ammonia limits are set equal to the applicable daily maximum ammonia limit. If the permittee elects to comply with daily ammonia limits with pH variable limits, the weekly and monthly average limits shall be set equal to the highest applicable limit of 108 mg/L.
2. Whenever a monthly average limitation is determined necessary to protect water quality, a weekly average limit shall be calculated using the following procedure and included in the permit unless a more restrictive limit is already determined necessary to protect water quality:

Weekly Average Limitation = (Monthly Average Limitation x MF)

Where:

MF= Multiplication factor as defined in Table 1

CV= coefficient of variation (CV) as calculated in s. NR 106.07(5m) = 0.6 for fecal coliform

n= the number of samples per month required in the permit

s. NR 106.07 (3) (e) 4. Table 1 — Multiplication Factor (for CV = 0.6) for **Fecal Coliform**

CV	n=1	n=2	n=3	n=4	n=8	n=12	n=16	n=20	n=24	n=30
0.6	1.00	1.31	1.51	1.64	1.95	2.12	2.23	2.30	2.36	2.43

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

- A weekly geometric mean limit of 656 #/100mL for fecal coliform is recommended. This limit is calculated using an assumed CV of 0.6 and multiplication factor of 1.64 based on weekly sampling.

Summary of Additional Limitations:

In conclusion, the following additional limitations are required to comply with ss. NR 106.07 and NR

205.065(7) Expression of Limits are in **BOLD**.

Parameter	Daily Maximum	Weekly Average	Monthly Average	Weekly Geometric Mean	Monthly Geometric Mean	Multiplication Factor (CV)	Assumed Monitoring Frequency (n)
Fecal Coliform				656 #/100ml	400 #/100ml	1.64 (0.6)	Weekly (4)
Ammonia Nitrogen Year-round	7.8 mg/L	7.8 mg/L	7.8 mg/L				

If the permittee elects to comply with daily variable ammonia limits, the following ammonia limitations would apply:

Parameter	Daily Maximum	Weekly Average	Monthly Average
Ammonia Nitrogen Year-round	Variable	108 mg/L	108 mg/L

Attachment #2

Map of Outfall 001

